

REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1, 2, 5, 10, 11, 13, 16, 21, 23-24, 29, 41, 42, and 55-66 are presently active. Claims 3-4, 6-9, 12, 14-15, 17-20, 22, 25-28, 30-40, 43-47 and 49-54 have been previously canceled without prejudice or disclaimer. Claim 48 has been presently canceled without prejudice or disclaimer. Claims 1, 2, 5, 13, 16, 23, 29, 41, 42, and 56 having been presently amended. Claims 57-66 have been added. No new matter has been added.

In the outstanding Office Action, Claims 1, 2, 5, 10, 11, 13, 16, 21, 23, and 24 were rejected under 35 U.S.C. § 112, second paragraph, for being indefinite. Claims 1, 10, 11, 13, and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Entley et al (U.S. 6,872,323). Claims 2, 29, 55, and 56 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Entley et al in view of Applicant's background art description. Claims 9, 10, 20, 21, 23, 54, and 55 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Itano and further in view of Jain et al (U.S. 6,613,682). Claims 5, 16, 41, and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Entley et al and further in view of Sato et al (U.S. 5,861,601). Claims 23 and 24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Entley et al and further in view of Jain et al. Claim 48 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Chou San et al (U.S. 2004/0043626) in view of Applicant's background art description.

Applicant acknowledges with appreciation the courtesy of Examiner Deo to conduct an interview in this case on September 9, 2010, during which time the issues in the outstanding Office Action were discussed as substantially summarized hereinafter.

Amendment Synopsis: The amendments to the claims and new claims are supported by the specification as follows.

(1) Amended Claim 1 is supported by paragraphs [0074] to [0077] and so forth in Applicants' published application (US 2007/0163617 A1).

(2) Amended Claims 13 and 29 include the same amendments as amended Claim 1.

(3) Amended Claim 2 is supported by paragraph [0073] and so forth in Applicants' published application.

(4) Amended Claims 5, 11, 16, 41 and 42 merely reflect clarifications of these dependent claims to be consistent with amendments to the independent claims.

(5) Amended Claim 56 is supported by paragraph [0090] in Applicants' published application.

(6) Amended Claims 23 and 24 are supported by paragraph [0078] in Applicants' published application.

(7) New Claims 57 and 58 recited the same claim element as amended Claim 24.

(8) New Claims 59 and 60 recite the same claim element as amended Claim 23.

(9) New Claims 61 and 66 are supported by paragraph [0117] in Applicants' published application.

Thus, no new matter has been added.

Amended Claims 1, 13, and 29 clearly state that cleaning gas plasma is used to remove a metal oxide, such as tungsten oxide, with which the process chamber is contaminated. The examiner will appreciate that, with regards to the claimed plasma cleaning gas, H ions and radicals of the plasma can serve to deoxidize metal oxide, such as WO_x, back into metal, which is more reactive. Further, O ions and radicals of the plasma can serve to oxidize and sublime the deoxidized substance or metal thus generated from the metal oxide, such as WO_x, inside the process chamber, whereby the sublimated substances are exhausted along with exhaust flows.

Regarding the 35 U.S.C. § 112, second paragraph, rejection: The claims have been amended to address the issues raised in the Office Action. Thus, the 35 U.S.C. § 112, second paragraph, rejection has been overcome, as discussed during the interview.

Art Deficiencies: M.P.E.P. § 2143.03 requires that *all words in a claim must be considered* in judging the patentability of the claim against the prior art. M.P.E.P. § 2141 II indicates that, in short, the focus when making a determination of obviousness should be on what a person of ordinary skill in the pertinent art *would have known* at the time of the invention, and on what such a person would have reasonably expected to have been able to do *in view of that knowledge*.

As discussed during the interview, Entley et al describe a method for forming a film containing W on a target substrate by CVD or the like and then cleaning a by-product film containing W deposited on the inner surface of the chamber. The cleaning of this method comprises a first step of using fluorine-based first plasma to remove the by-product film, and a second step of using second plasma of a mixture of an oxygen-containing gas (such as N₂O gas and O₂ gas) and a hydrogen-containing gas (such as NH₃ gas or H₂ gas) to remove fluorine-containing contaminants (HF) generated in the first step. Thus, when the second step is applied, the W product film has been removed earlier by the fluorine-based plasma.

Accordingly, as discussed during the interview, the use of a plasma mixture of an oxygen-containing gas and a hydrogen-containing gas in Entley et al is **not** for removal of a metal oxide (as presently claimed), but rather is for the removal of fluorine-containing contaminants such as HF.

Indeed, Entley et al state at col. 5, lines 40-54:

After the fluorine-based plasma cleaning, fluorine residues, which may be the combinations of the residual gases (SiF₄, HF, F₂, COF₂, etc.) from the

fluorine-based chamber deposition cleaning, remain in the chamber. Thus, as shown in FIG. 1, in-situ fluorine residue cleaning (or removing) is performed to remove the fluorine residues. In this embodiment of the invention, a hydrogen-containing gas, NH_3 , and an oxygen-containing gas, N_2O , are supplied into the CVD chamber so as to form 70 mol % $\text{N}_2\text{O}/\text{NH}_3$ gas mixture, and the mixture is ignited to form an in-situ 13.56 MHz plasma. Exemplary process conditions of the fluorine residue cleaning are described below with reference to FIGS. 2 to 7.

Then, volatile fluorine products, primarily HF, that result from the reaction between the cleaning plasma and the fluorine residues are evacuated from the chamber. The H_2O generated from the exothermic reactions discussed above is also evacuated with the volatile fluorine products from the chamber.

Hence, Entley et al fail to disclose or suggest:

- supplying a cleaning gas (into the process chamber) consisting of O_2 gas and H_2 gas and an inactive gas or consisting of O_2 gas and H_2 gas with a ratio of the H_2 gas relative to the O_2 gas set at 2 or more;
- applying the plasma to the metal oxide to sublime the metal oxide;
- and
- removing the sublimated metal oxide thus generated from inside the process chamber along with gas being exhausted.

These deficiencies in Entley et al are not overcome by Sato et al or Jain et al.

Sato et al describe a method for etching an aluminum alloy (Al-Si-Cu) on a substrate by use of $\text{BCl}_3/\text{Cl}_2/\text{CH}_2\text{F}_2$, and then describe the cleaning of an empty chamber by use of plasma of O_2 or $\text{O}_2 + \text{SF}_6$ gas.

Jain et al describe etching of DARC (dielectric antireflective coating)/ Poly-silicon on a substrate by use of $\text{CF}_4/\text{HBr}/\text{Cl}_2/\text{He}/\text{O}_2$, and etching of DARC / Tungsten silicide on a substrate by use of $\text{NF}_3/\text{Cl}_2/\text{He}/\text{O}_2$.

Moreover, these deficiencies in Entley et al are not met by inherency. M.P.E.P. § 2112 states that, to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference and that it would be recognized by persons of ordinary skill. M.P.E.P. § 2112 further states that

inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.

Here, the description in Entley et al noted above makes clear that their removal products are “volatile fluorine products, primarily HF,” with no indication or suggestion that any W is left in the chamber, or if left that the W would be exposed to their N₂O/NH₃ gas mixture, or if the N₂O/NH₃ gas mixture (or the other mixtures described therein) would sublimate any residual W left in the chamber. Accordingly, a person skilled in the art would be only left to guess as to whether or not there is any W available on the chamber walls of Entley et al after Entley et al’s fluorine cleaning step. Indeed, the implication is that the cleaning step would remove all of the W. Furthermore, a person skilled in the art would be only left to guess as to whether or not Entley et al’s fluorine cleaning step would sublimate the W, if in existence.

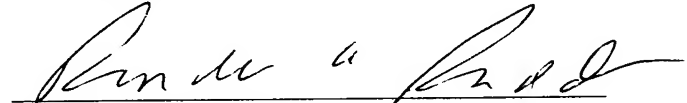
Hence, the claimed “applying the plasma to the metal oxide to sublimate the metal oxide” would **not** be recognized by persons of ordinary skill as being necessarily present in Entley et al.

Hence, independent Claims 1, 13, and 29 (and the claims dependent therefrom) should be passed to allowance.

Conclusion: In view of the present amendment and in light of the above discussions, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read "Steven P. Weihrouh", is written over a horizontal line.

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